A SPRUING ASSEMBLY

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to investment casting and, more particularly, this invention relates to an improved spruing assembly in the making of investment mold castings.

2. Description of the Prior Art

The casting of miscellaneous items by both jewelry and dental technicians utilize the lost wax process. For dental technicians, the lost wax process is used for several dental restoration procedures including crown restorations, inlays, bridges, and coping. For a typical crown restoration, an impression of the patient's teeth is taken by a doctor, and a model of the teeth is made from the impression. One or more layers of wax are built-up onto the model to an exact replication of the crown or the substructure. The finished wax structure of the crown is removed from the model and placed for investing in a casting ring. Sprues are utilized to support the wax structure in a sprue holding member attached to a base unit

of the casting ring. It is common to attach one end of the sprue onto the wax structure to remove the wax structure from the model and attach the opposed free end of the sprue to the sprue holding member. The casting ring is then filled with investment material which solidifies. The solidified investment material is removed from the casting ring and base unit and heated to burn out the wax structure, sprues, and sprue holding member. Thereafter, a metal is melted down and cast into the void created by the burned out structures. After the metal is cooled, the investment material is removed to expose the cast structure and assembly.

One of the problems arising in this process is the potential for movement of the sprue at the attachment point to the sprue holding member of the base unit. Typically, sprue holding members can be a chunk of wax, a runner bar, or a runner wheel. The sprues are commonly made of wax or plastic. For sprues made of wax, the sprues are attached to the sprue holding member by heating a portion of the tip of the sprue and immediately connecting the heated portion onto the holding member. For sprues made of plastic, the sprue is connected to the sprue holding member by melting a piece of wax with a waxing tool between the sprue end and the holding member and allowing the wax to harden. In

multi-wax unit structures, a sprue connects each unit to the sprue holding member. It is important in such multi-unit structures that each sprue does not shift, even slightly, along its connection with the holding member; otherwise, slight shifting can negatively affect the precise fitting of the final dental product. However, with the conventional method of connection as described, there can be a tendency for a slight shift resulting from the investing process because wax has inherit memory which can cause expansion and contraction with heat change occurring in the investing process.

Another problem with the typical lost wax process is the time consuming nature of the step of connecting the sprue to the sprue holding member, especially for connecting multi-unit wax structures. Currently, the dental technician must have one hand holding the wax structure with the sprue and a waxing tool in the other hand to attach the end of the sprue to the sprue holding member. This can be tedious and time consuming when attaching multiple sprues at multiple angles for a multi-unit structure. In addition, in multi-unit structures, each sprue must be connected at a proper angle, and this may require bending of wax sprues, or reattachment of plastic sprues to form the proper angle of connection of

each sprue. A problem with bending of wax sprues in multi-unit wax structures is the potential for shifting which may exert a slight pressure on the corresponding unit of wax structure, which in turn may affect the precise fit of the finished product.

Thus, it is an object of the present invention to provide an improved spruing assembly which provides a secure connection between the sprue and the sprue holding member. It is another object of the present invention to provide a spruing assembly which provides quick and adjustable connection between the sprue and the sprue holding member. It is another object of the present invention to provide a spruing assembly for producing precise castings of multi-unit wax structures.

SUMMARY OF THE INVENTION

The present invention is an improved spruing assembly utilized in the investment mold process for the making of castings. The spruing assembly comprising a base unit engaged to a casting ring to define a receptacle for receiving investment material, and a sprue holding member connecting to the base unit within said receptacle and supporting thereon one or more sprues for holding a wax

structure formed from a stone model in a pattern to be cast. The sprue has a first end connecting to the wax structure and a second end for connecting to the sprue holding member. A curved adapter is placed at the second end of the sprue for quick locking of the second end of the sprue onto the sprue holding member. The curved adapter allows for a secure connection which will allow the sprue to rotate at the second end with the application of a predetermined amount of force; however, the connection is sufficiently strong enough so that the sprue will not move nor rotate during the entire investment process. The sprue holding member can be a runner bar formed of one or more elongated bars or a ring having a central plug with a plurality of radial bars extending from the plug to the ring. The wax structure, sprues, and sprue holding members are all made of materials which will burn out during the investment process.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a perspective view of a multi-unit wax structure connected by sprues to a runner bar as the structure is being removed from the model formed from a dental impression;

Figure 2 is an isolated view of a sprue and runner bar of the present invention;

Figure 3 is an isolated view of an embodiment of a sprue and runner bar of the present invention;

Figure 4 is an isolated side view of and an end the sprue and runner bar;

Figure 5 is an isolated view of an embodiment of a runner bar of the present invention;

Figure 6 is a side view of the runner bar of figure 5;

Figure 7 is an isolated view of another embodiment of a runner bar of the present invention;

Figure 8 is a side view of the runner bar of figure 7; and,

Figure 9 is a sectional, partially broken view of the spruing assembly of the present invention filled with investment material.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

The present invention illustrated in Figures 1 to 9 is a spruing assembly 10 comprising a base unit 15 engaged to a casting ring 17 to define a receptacle. The casting ring 17 is formed to be removeably connected to the base unit 15. Furthermore, the base unit 15 shown in the

illustration has a channel 20 in a ring pattern forming a slot for receiving the bottom edge 22 of the casting ring 17 for a secure fit so that the receptacle is suitable for receiving investment material 25 therein without leakage. In the embodiment shown in figure 9, the casting ring 17 is tapered. The vertical cross-sectional shape of the casting ring can be elliptical, circular, or any other shape known in the art suitable for fitting over and housing the sprue holding member 28, sprues 30, and wax structures 33.

Also, the spruing assembly 10 comprises a sprue holding member 28 connected to the base unit 15 inside the receptacle. The sprue holding member 28 is made of a material which will burn out during the heating process along with the wax structure 33 and sprues 30. In the embodiment shown in figure 9, the sprue holding member 28 is a runner bar 36 formed as an elongated bar. The runner bar 36 can have a plug 38 attached thereto for connection into a hole formed in the base unit 15. The plug 38 can be a preformed plastic structure or a suitable mass of wax. Figure 5 shows an alternative embodiment of the sprue holding member 28 formed as three elongated runner bars attached to a plug 38. Figure 6 shows another alternative embodiment of the sprue holding member 28 formed as a ring 40 having a central plug 38 and a plurality of radial bars

42 extending from the central plug 38 and connecting to the ring 40. In each embodiment of the runner bars, the cross-section of each runner bar is arcuate. The plug 38 in each embodiment also is made of a material which will burn out during the heating process. In the embodiments shown in figures 1-9, each sprue holding member 28 has a circular cross-section.

Supported on each sprue holding member 28 is a sprue 30 connecting to a wax structure 33 formed in a pattern to be cast. Figure 9 shows a 3 unit wax structure 33b having a separate sprue 30 connecting each unit of wax structure 33 to the sprue holding member 28. Two embodiments of suitable sprues 30 are shown in figures 1 and 2. Figure 3 shows a sprue 30 having a first end 47, which is the end connecting to the wax structure 33, and a second end 49 which has an adapter 50 formed thereon for locking onto the sprue holding member 28. The adapter 50 is curved generally in a semi-circular shape to define an opening for receiving therein the sprue holding member 28. That is, the adapter 50 is sized and shaped to grip sufficiently around the sprue holding member 28 to lock onto the sprue holding member 28 in a secure engagement. Also, the adapter 50 is sized and shaped to cover at least half of the circumference of the sprue holding member 28. The

radius R1 of the adapter can be adjusted relative to the size of the sprue holding member 28 to control the strength of the force with which the adapter 50 locks onto the sprue holding member 28. For multi-unit wax structures, it can be desirable that the angle of the sprue 30 on the sprue holding member 28 be adjustable, which requires that the sprue 30 rotate at the connection to the sprue holding member 28 with the exertion of at least a predetermined amount of force on the sprue 30. Although rotatable, it is important that the adapter 50 be sufficiently locked onto the sprue holding member 28 so that the sprue 30 will not rotate nor move during the investment process. Figure 4 shows an isolated side view of the adapter 50 of the sprue above a side view of the a runner bar 36. The adapter 50 has a radius R1 of a first predetermined length, and the sprue holding member has a radius R2 of a second predetermined length which is longer than the first predetermined length. The adapter also has a depth R3 of a third predetermined length. For a rotatable yet secure fit which will not rotate during the investment process, it has been found for an adapter which is made of plastic that the second predetermined length R2 is in the range of 9.2% to 11.4% longer than the first predetermined length R1, and the third predetermined length R3 is in the range of 29% to

48% longer than the first predetermined length R1. To effectuate a gripping force on the sprue holding member 28, the adapter 50 is relatively flexible. Figure 2 shows a sprue 30 having a reservoir 53 formed between the first and second ends 47, 49 thereof. The sprue 30 along with the adapter 50 and any reservoir 53 formed thereon is made of a material which will burn out in the heating process, and common materials in the art for sprues include wax and plastic. Sprues can be hollow or solid. In the embodiment shown, at least the first end of the sprue is hollow. A sprue being hollow at the end connecting to the wax structure provides an advantage in allowing for increased surface area of connection between the sprue 30 and the corresponding wax structure 33. This is because a sprue having a hollow end when connected to the waxing tool using a waxing tool has the entire circumference of inner and outer sides of the end of the sprue connecting to the wax structure; whereas, in a solid sprue end, only the circumference of only the outer side of the end of the sprue connects to the wax structure.

Using the present sprue assembly, a wax structure is first formed from the stone model formed from the dental impression. For a single unit wax structure, the first end of a sprue is connected using a waxing tool to the wax

structure. Thereafter, the wax structure is then removed from the stone model and snapped onto the sprue holding member which is placed onto the base unit. It is also possible to have the second end of the sprue first snapped onto the sprue holding member prior to attaching the first end of the sprue onto the wax structure for removal of the wax structure from the stone model. After the sprue holding member is set onto the base unit, the casting ring is placed on the base unit and investment material is poured into the receptacle to cover the sprue holding member, sprue, and wax structure. For making many separate single unit wax structure casts in a single investment process, sprue holding members shown in the embodiments of figures 5 and 6 are desireable for its ability to hold many single unit wax structures.

For a multi-unit wax structure, the present invention allows for the sprues to be first snapped onto the sprue holding member. For multi-unit structures, a sprue holding member being a single elongated or curved runner bar is preferred. Once the sprues are snapped onto the runner bar, the length of each sprue can be cut and the angle of each sprue can be adjusted by rotating the sprue at the adapter so that each sprue can be in optimal position for connection to the corresponding unit of wax structure.

After each sprue has been optimally aligned and sized, each sprue is connected to each corresponding unit of wax structure. As an additional step, to ensure that an adapter will no longer rotate after the sprue is connected to the wax structure, the user can bond a piece of melted wax between the adapter and the sprue holding member.

Although embodiments of the invention have been described and illustrated for purposes of clarity and example, it should be understood that many changes, substitutions and modifications to the described embodiment will be apparent to those having skill in the art in light of the foregoing disclosure without departing from the scope and spirit of the present invention which is defined by the claims which follow.